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Report of the
NINTH SOUTHERN PASTURE AND FORAGE CROPS
IMPROVEMENT CONFERENCE

Agricultural Experiment Station
of the
Louisiana State University

Baton Rouge, Louisiana
April 24 - 25, 1952.

Thursday, April 24, 1952

8:30 A.M. Registration - Lobby, Pleasant

T. H. Rogers, Chairman

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Friday, April 25, 1952

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J. K. Leasure, Chairman

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Friday, April 25, 1952

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G. W. Burton, Chairman

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Report of the
NINTH SOUTHERN PASTURE AND FORAGE CROPS
IMPROVEMENT CONFERENCE 207979

Thursday, April 24, 1952

8:30 A.M. Registration - Lobby, Pleasant Hall.

9:00 A.M. Opening Session - T. H. Rogers, Chairman

The Chairman called the Conference to order. The program proceeded as planned.

9:05 A.M. Greetings to Visitors, by J. G. Lee, Jr., Dean,
College of Agriculture.

I am delighted to be here with you and to extend you greetings from the University and the College of Agriculture. This building where most of you are staying was set aside by the University to take care of such groups as you. I hope you have a pleasant stay.

I want to stress one point --- our population is increasing and we have 55 million people in this country at the present time. It is increasing at the rate of about 2 million per year. The balance between consumption and production has gotten down pretty thin. In other words, we just about have balanced it. This is a boon to farmers of this country because that points the way to good prices. It is up to you to show the way to get more out of the acres we are now cultivating and the acres that are in pasture. We must increase the pasture work and we are trying to do that in this state. We are interested in this whole program of forage crops, pasture, fertilization, control of insects and diseases. With regard to insecticides and fungicides, we are dependent upon you folks to show us the way in this whole program.

Again let me extend a hearty welcome and hope your stay will be profitable.

9:15 A.M. Introduction of Members, by States.

9:30 A.M. Forage Crops Research at the Louisiana Agricultural
Experiment Station - W. G. Taggart, Director.

It pleased me very much when you accepted our invitation to hold this meeting here. Louisiana will gain materially from the information you will be able to release here today.

I do not like to speak from statistics but I think that is probably the best way to bring out what a great field you have in front of you. There are 1,142 million acres of land on farms in the United States of which only 353 million acres are in crops that are harvested. One

hundred nine million acres are in plowable lands used only for pasture and 420 million in unplowable, unimproved pasture. Add to this, 95 million acres of pastured forest and woodland for a total of 624 million acres in pasture lands on farms in the United States against 353 million acres that are harvested.

The farm land or lands on farms make up 59.9% of the land in the United States, while 40.1% of the balance is not on farms. Four hundred twenty-eight million acres of land not on farms are grazed, or a total of 1,052 million acres of land grazed.

Here in Louisiana we are trying to do something about the above situation. I want to cite one accomplishment on the part of the Louisiana Agricultural Experiment Station. A few years ago there was a movement fostered by the Farm Bureau and the Louisiana Dairy Association to set up a demonstration program but the Director of the Agricultural Extension Division did not want the demonstration farm. The job was assigned to the Experiment Station. They gave me the poorest piece of land in Louisiana and told me to make an Experiment Station on it. The first two years I thought the project was going to be a failure. Members of our staff worked it out and I want to give you one year's Experiment Station accomplishments of the Dairy and Livestock Experiment Station at Franklinton. On the 16th of December we started grazing winter pastures and early spring pastures and grazed continuously until the 18th of May. This pasture produced \$107.50 above the cost of building and pasture and the cost of supplemental feed for the cattle. Notice that this pasture was grazed until the 18th of May. On the 19th of May we went on summer pasture. This pasture was grazed until the 30th of November. From the milk sales, above the cost of building the pasture, we got \$122.86 per acre, and from the two acres, \$231.36 -- that is applied research, I think.

10:00 A.M. Latest Developments in the Use and Fitting Together of Various Types and Kinds of Pasture in a Year-round Grazing Program - R. H. Lush, Chairman.

Dr. Lush, before introducing the speakers, called attention to relatively recent changes in the values of good pastures. Twenty years ago, in contrast to Director Taggart's report on pasture returns, \$20.00 would have been a top value for good pastures. Dr. Lush stated further that back in those days the irrigation of pastures would have been considered absurd, yet this past year in Tennessee, 12,405 pounds of milk per acre, having a value of \$624.00 was obtained from April to November 1 at a cost of \$174.00. There was a net return for irrigation of \$121.00 per acre. Alfalfa-orchardgrass grazed in a 20-day rotation has given good results for two years.

A lantern slide showing, by schematic diagram, the actual growing period of various forage crops adapted to the area in question, was shown and discussed by Dr. Woodhouse. At the beginning, he stated that year-round grazing is not obtained in North Carolina. The length of the grazing period will vary over the region, due to location, soil fertility and rainfall. There is a long list of plants which can be used to extend the grazing season. The more important of these and the time when actual growth takes place is as follows:

Alfalfa	April thru October
Ladino clover	Mid-February thru November
White clover	March thru Mid-June, Sept. thru Mid-Nov.
Lespedeza	June to October
Crimson clover	Mid-February to June 1
Kudzu	June to December
Orchardgrass	March to November 15
Tall fescue	February to December 5
Ky. bluegrass	March to December 1
Small grains	February thru Mid-May
Ryegrass	February to June 1
Sudan grass	June to November 1

Dr. Woodhouse stated that we believe that a farmer can use a combination of these species and make a grazing program work within reason. We are stressing the use of perennial grasses and legumes for two reasons; first, once established, you do not have the hazard of re-establishment each year. Secondly, utilization of perennial species usually results in lower costs. Ladino clover, orchardgrass and tall fescue are the better perennial species. A large portion of the pastures of this region should be composed of these species. A summer slump in production usually occurs with these species -- fertilizers pay, especially in dry summers. The number of acres of other grazing species such as the annual lespedezas, crimson clover and small grains needed to extend the grazing period and fill in the summer slump of perennial species, will depend on the location, soil type, etc., within the region.

Small grains, Sudan grass and other annuals make good silage crops if not needed for grazing. By fertilization and management, tall fescue is being substituted for the relatively large acreage of small grains for winter grazing. Tall fescue, heavily fertilized with nitrogen, is not the cheapest kind of winter grazing.

Discussion

Dr. Blaser, of Virginia, called attention to the forage situation in the Northeast, where the greatest stress is in producing hay and silage crops. There is a tendency for the farmers of that area to

neglect pastures. We cannot get 12 months of grazing in Virginia. Plant growth is related to temperature and light. Greatest growth occurs in the spring. Light intensity and temperatures are low in winter, resulting in little or no plant growth, regardless of water supply. We may do our farmers an injustice by talking 12-month grazing. Farmers cannot adjust animal numbers but must provide grazing for all animals at all times.

In Virginia there is little grazing from December to April 15. In utilizing Kentucky bluegrass, supplementary grazing is emphasized. Fescue and orchardgrass in association with Ladino clover, and orchardgrass and alfalfa mixtures are important. Early grazing is from fescue-Ladino and Kentucky bluegrass. Early crop orchardgrass may be cut for hay or silage. Properly fertilized tall fescue, rested in August and September, will provide grazing into late December. Lespedeza is grazed in mid-summer. We can see no important place in our program for annuals as grazing crops.

Lower Piedmont or Lower South - D. G. Sturkie, Alabama.

Slides were shown by Dr. Sturkie of the seasonal trends in milk or beef production of various herds in experiments in Alabama. Even though animals had ample forage most of the time, production declined from the peak period in late spring or early summer. Forage quality and temperatures may be factors largely responsible for the downward trend.

Crimson clover, small grains, and ryegrass to a limited extent, are the main species for winter grazing. Bermuda or Dallis grass and white clover is the basic permanent pasture over much of the area. According to Dr. Sturkie, the acreage of Coastal Bermuda is increasing and while we have not had enough experience with it, we feel that it will be of great importance in the state. Summer gains in beef and milk are being made on Coastal Bermuda. We cannot get gains in beef or milk production on pure stands of tall fescue. Tall fescue is considered as satisfactory for maintenance. Bahia and lespedeza are important in the Lower South. Production from sericea lespedeza is often greater in the Piedmont than from Dallis grass and white clover. Milk production declines when cattle are pastured on sericea. We feel, too, that there is a real place for temporary grazing plants in the pasture programs of the region. Kudzu has a place in pasture programs in this region. Chief objections to it are that it is expensive to establish and will not withstand close grazing. Cows make gains in milk production on kudzu. Excellent gains of both beef and milk are secured when alfalfa is grazed or fed as hay. Cattail millet and Sudan grass have a place in the forage program for summer grazing.

Discussion

The question was asked, if the summer decline began as the legumes disappeared from the pasture. This is the case. Grazing kudzu, lespedeza and alfalfa was suggested. Decline in milk production occurs even though these legumes are available. The reason for this has not been thoroughly tested.

The question of whether the higher temperatures affect the animals themselves, was not answered. Dr. Sell, of Georgia, reported that in trials last year, the forage in late summer was less digestible. Sudan grass increased intake of forage by cows. Dairymen may keep the cows in the barn at night, when it is known that some cows graze better at night. More attention to time of grazing might help milk production.

Dr. Hollowell, Bureau of Plant Industry, Soils and Agricultural Engineering, pointed out that one of the most productive phases in plant research is the determination of species and variety adaptation to different environments. I believe that one of the reasons for the wide variation and particularly poor gains in animal performance is lack of animal adaptation. Rhoades, in his work at Jeanerette, La., showed significant differences between breeds and their hybrids in their capacity to gain during the summer months, cases of animal adaptation. More basic studies are needed along these lines.

11:00 A.M. Pasture for the Rice Section of the Gulf Coast Area,
R. K. Walker, Louisiana.

Ninety percent of the rice, the second ranking cash income crop in Louisiana, is produced in 7 parishes, which represent 15.1% of the total farm area in the state. In addition, these 7 parishes pasture 23.5% of the total beef cattle population of the state. A large percentage of the cultivatable land of this area is devoted to rice and pasture. Briefly, the most widely used rotation system is one year in rice and one year in native pasture with a system of one year in rice and two or three years in improved pasture rapidly gaining favor with farmers. Rice-pasture rotation experiments have been conducted on a rather large scale for the past 14 years and it has been found that native pastures under the 1 - 1 rotation produced an average of about 50 pounds of beef per acre annually and an average of about 42 bushels of rice per acre, while under a 3 - 2-year rotation an average of 300 plus pounds of beef and 70 bushels of rice was produced. In addition, it has been determined that with improved pastures which furnish good grazing from February 15 to November 15, supplementary pastures, both winter and summer, profitably furnish sufficient green pasture and hay to keep beef animals grazing continuously during the entire 12 months of a year at an average rate of 1.4 pounds per animal per day when grazed at an average of one animal per acre for a 9-months period and

.69 per acre during the 3-months winter grazing period. A slightly greater average gain per animal was obtained during the 3-months winter grazing period than was obtained from the 9-month improved pasture grazing period, although the number of animals grazed per acre was somewhat less on the winter grazing than on the improved pasture.

Improved pastures are secured in the rice area by seeding with Louisiana White Clover, Common lespedeza, and native Dallis grass, with good stands of native Bermuda grass being obtained without seeding. Oats are widely used for winter grazing. An average of about two tons of Kobe lespedeza hay was harvested from the land that was planted to oats for winter grazing and overseeded with lespedeza during the month of February and an average of about 23 bushels of oats were harvested after grazing. The lespedeza was also used to supplement the improved pastures during the extreme dry periods that sometimes occur during July and August. The 12-month continuous grazing system was evolved from the original experiments and much attention is now being devoted to testing new species, varieties, and strains of all potential pasture and forage crop plants in an effort to obtain plants superior to the ones in common use and to find plants that will smooth out the rough spots in our grazing program.

As I was asked to present the newer and more promising work in the area, I will briefly discuss plants under investigation that have shown considerable promise.

Summer Grasses:

Many promising summer grasses have been tested. Pangola and Coastal Bermuda have produced from 4 to 5 times as much forage clippings from plots as has domestic Dallis grass. As these grasses have to be propagated vegetatively, their use is very limited in the rice area. They could prove to be valuable under permanent pasture conditions. The two strains of Dallis grass, B-230 and 430, produced considerably more forage than domestic Dallis grass. We are now producing seed of the B-230 for release to seed producers.

Winter Grasses:

Information obtained from experimental plots testing 16 winter grasses showed that none are as dependable for a full time grazing as are Camellia and Southland oats. The various fescues have made poor growth for 4 years and cannot be generally recommended for beef cattle production in the rice area.

Summer legumes:

As lespedeza is the only summer legume that prospers in the rice area, 17 plots and varieties of lespedeza have been tested and Kobe lespedeza remains the highest forage producer. It is recommended for a summer hay crop while Common is still recommended in an improved

pasture mixture due to its ability to produce seed under close grazing and the characteristic of late maturing. A mixture containing both varieties would probably be desirable

Winter Legumes:

Fifty-one winter legumes have been tested for adaptability to the area and of these legumes the two Louisiana Synthetics, No. 1 and No. 2, have proved far superior in all respects to any other white clover. This legume has not been tested under large scale grazing conditions due to unavailability of seed. Seed will be available to commercial growers from our station this year.

To summarize briefly: 12 months of continuous grazing can be carried out in the rice area. An average carrying capacity of .995 animals per acre is obtained for 9 months on improved pasture, with .69 animals per acre for 3 months on oats, resulting in average gains of 1.4 pounds per day or 511 pounds per year. Also, an increase in yield of rice of 28 bushels per acre is obtained in the rotation system. This data covers the past 5 years of grazing experiments. More recent experiments indicate higher grazing capacity and higher yields of beef per acre with the promise of some of the rough spots in the continuous grazing system being smoothed out.

Pangola and Coastal Bermuda have proved to be superior forage producers in test plots but due to propagation characteristics they have not been found to fit into the rice farmer's program as yet. Dallis grass still remains the most promising grass for spring, summer and fall pastures, with two new strains, B-230 and 430, having proved superior to domestic Dallis grass.

To date, oats is the most dependable winter grazing crop that has been tested. The Southland oat and Atlas 66 wheat appear promising, both for winter grazing and for grain production.

1:30 P.M. Trip to Agronomy Farm - C. R. Owen, in charge.

The group traveled by car to the Agronomy Farm where many forage variety and fertilizer experiments were being conducted. Mr. Owen and his associated reported on the results of the various tests under way. Observed were tests of the following:

Crimson clover varieties (second year)
White " "
Red " "
Oats, rye and ryegrass
Winter grasses (perennial)
Subterranean clover

Trip to Agronomy Farm (cont.)

White clover clonal lines
Brome grass varieties
Ryegrass
Tall fescue varieties
Orchard grass
Rescue grasses

Detailed results of each of the experiments had been mimeographed and copies were given to all present. Attention was called to varietal differences in growth of the numerous varieties and strains under test. Members of the Conference, in addition to learning the facts about the various varieties, were very favorably impressed by the large array of well cared for test plots.

Friday, April 25, 1952

SPLIT SESSION I - J. K. Leasure, Chairman Pleasant Hall, Room C.

8:00 A.M. Pasture Production and Management

The initial topic for discussion was "Techniques in Pasture Research". Drs. Woodhouse and Lucas of North Carolina and Dr. Crowder of Georgia led the discussion. After briefly reviewing the literature pertaining to best techniques, the major problems in techniques were outlined. These included the following questions:

1. What is the best size of test pasture to use for experimental work?
2. How many such pastures are needed to evaluate a single treatment?
3. What is the most satisfactory number of animals per plot (this usually develops into what is the satisfactory minimum number of animals)?
4. How should animals be managed to utilize the flush growth of the spring grazing period? This involves questions such as: should a given number of animals be stocked on the pasture during the entire grazing season and flush spring growth clipped off or should extra animals be added to the test during these periods and removed during summer?

5. How can agronomic (small plot results) and animal results be best correlated. This topic included such things as; should extra areas be set aside for clipping or should cages be used in the test pasture? The use of chromogen (chromic oxide) techniques was also discussed. Questions raised were how to tell exactly what forage the animal ate under this sort of test and how to mow a pasture for agronomic data to simulate such grazing.

There was considerable discussion from the floor on all phases of this problem. The two questions which seemed to raise the most interest were how many replications are essential for pasture work and how large must the plots be. Next in interest was the problem of correlating of small plot and animal results. None of these problems were solved but it was agreed that some research aimed at primarily solving these technique problems seemed to be needed.

10:00 A.M. Fertilization Practices - The Use of Nitrogen on Grass to Supplement or Replace Legumes, and Other Developments.

Dr. Sell of Georgia, Dr. Hogg of Mississippi and Mr. Jones of Florida led the discussion. As outlined here, the aim of any pasture program is to provide the best possible total feed supply and the highest possible quality of feed. To do this satisfactorily, a mixed grass-legume stand is necessary. There is insufficient evidence available to support the belief that heavy nitrate fertilization can replace legumes and maintain feed supply quality.

The basic needs for nitrogen, phosphorus and potash in the various soil regions of the Southeast were discussed. Of primary interest to the group was nitrogen fertilization. Questions were raised and results for various experiment stations were discussed which show that nitrogen responses are extremely variable. The responses in growth vary widely, depending upon soil type, pasture mixture under study, method of application of nitrogen, and grazing management. There is ample evidence that high response to nitrogen is dependent on a sufficient supply of soil moisture. The question of nitrate poisoning was raised but this was quickly degenerated into a discussion of bloat and nothing was accomplished.

11:45 A.M. Lunch.

1:00 P.M. Methods of Management to Secure Maximum Returns as Affected by Forage Species, Nutritive Value, Environment, and the Grazing Animal.

This discussion was led by Dr. Blaser of Virginia and Mr. Brooks of Georgia. Continuous, rotational, and delayed rotational systems of grazing management were discussed. Results of various experiments under each type of grazing management were presented. The presentation showed that management becomes more important as total returns

per acre increase. Management is also more critical in experiments with dairy cattle where milk production is the final measure than it is in beef cattle experiments where animal gains is the final measure.

Several questions were raised and discussed from the floor. One of primary interest seemed to be whether or not pasture could supply a suitable feed without being supplemented by grain. The trend seemed to be that higher yields can be maintained using a small amount of grain, supplemental to pasture, although no cost data were presented to show that this was profitable.

2:15 P.M. Problems in Establishing Pastures.

Dr. R. C. Potts of Texas, and Dr. G. B. Killinger of Florida, led the discussion. Three major problems are evident in pasture establishment:

1. Lack of adequate seedbed preparation.
2. Seeding rate.
3. Seeding methods.

Many different methods of pasture establishment are being used with varying degrees of success although no one system is uniformly successful. Little research is under way at the present time or contemplated to establish the best methods of pasture seeding.

2:50 P.M. Session adjourned.

Friday, April 25, 1952

SPLIT SESSION II. Breeding of Forage Crops - Pleasant Hall, Room A.

8:00 A.M. Breeding of Grasses - G. W. Burton, Chairman.

In calling the meeting to order, Dr. Burton stressed the importance of discussion in the development of topics to be covered. The grasses for discussion were the most important ones, as determined in a canvass of the membership in late winter. The program proceeded as planned.

Tall fescue - R. C. Buckner, Ky.

Dr. Buckner had contacted southern grass breeders before the meeting with regard to breeding objectives and work under way on tall fescue at the various stations. The results of this questionnaire were summarized, mimeographed, and passed out to those in attendance. According to this summary sheet, tall fescue is a hexaploid but behaves meiotically more or less like a diploid. It is largely

cross-pollinated with considerable variation existing in many characteristics. Interspecific and intergeneric crosses are difficult to make.

The breeding objectives in the various state programs have been averaged and are given in table 1. The most important single objective in breeding tall fescue is improvement in palatability. Breeding for resistance to Helminthosporium dictyoides and Rhizoctonia solani is secondary only to increased palatability in tall fescue. Breeding for higher yield, increased compatibility with legumes and greater longevity rank in importance in the order named. Additional objectives of state or local interest were reduced seed shattering, more heat and drought tolerance, sustained productivity with age, increased leafiness and greater aggressiveness when grown alone.

Some progress has been made in breeding for greater palatability in Kentucky and Mississippi. Progress in breeding for disease resistance was reported from Georgia and Mississippi. Much improvement in yield is reported from Mississippi, with some progress being made in Arkansas and Georgia. Dr. Buckner reported on the palatability study under way at the Kentucky Station. Some 2700 spaced plants of Ky. 31 were grazed 4 times during 1950. Ten plants were found that were more palatable than others. In general, plants having stiff leaves were least palatable. Plants having soft, droopy leaves were more palatable. From the discussion it was pointed out that the same relationship seemed to hold for Sudan grass and cattail millet.

Dallis grass, *Paspalum dilatatum* - C. R. Owen, La.

The southern grass breeders had been contacted before the meeting as to objectives and progress of breeding with Dallis grass. The relative importance of the various factors in the breeding programs are given in table 1. The cytologists are agreed that apomixis or asexual reproduction is most likely in this species. The somatic chromosome number is 40, but 50 chromosomes have been reported.

According to the survey, disease resistance is of most importance over the region. A search for resistance to ergot and to foliage diseases, primarily anthracnose, are the more important lines of endeavor. A second but also important objective, is breeding to secure greater seed viability and seedling vigor. Increased yield is third in importance in breeding programs. In the breeding program in Louisiana, progress has been made in securing strains having improved seed quality. Two strains of Dallis grass, designated as E-230 and 430, selected because of improved seed quality, are being increased in Louisiana. Progress in securing resistance to ergot and higher yielding strains is reported from Mississippi. General improvement in yield, disease resistance, frost tolerance and seed quality was reported from Louisiana. The need for more fundamental investigations was evident from the discussions.

Orchard grass, *Dactylis glomerata* - T. J. Smith, Va.

Dr. Smith was unable to attend the Conference. The summary he had prepared was presented to the Conference by Dr. Edwin James of the Division of Plant Exploration and Introduction at Griffin, Ga. The breeding objectives as reported for the southern states are given in table 1. Most of the southern states are doing little or no breeding work with this species. The summary presents possible objectives. It also indicates that heat and drought tolerance, disease resistance and greater longevity are the more important characters desired in an improved orchard grass. Some breeding work is under way in Virginia, Tennessee, Oklahoma and Arkansas.

Orchard grass is an autotetraploid ($2n = 28$) and is normally wind pollinated. Plants may vary from complete self-sterility to complete self-fertility. Inbred lines can generally be produced and maintained. Plants normally flower under longer days in the spring. Orchard grass does not readily flower in the greenhouse unless it is allowed to remain in the field in the fall until freezing weather occurs.

Ryegrass, *Lolium multiflorum*, E. C. Holt, Tex.

The breeding objectives according to Dr. Holt's summary, are listed in table 1. The importance of disease resistance, primarily resistance to rust, is stressed in these objectives. Florida, Arkansas and Mississippi reported progress in increased rust resistance. Greater fall growth and increased productivity were second and third in importance as breeding objectives.

Dr. Wallace (Fla.) reported on the progress being made in the program at Quincy, Fla. Plants apparently resistant to rust are being grown for further testing. Resistance to rust was found in locally volunteering stands of ryegrass. Dr. H. W. Johnson (Miss.) reported that certain introductions from Uruguay, P.I. 193145, 194394 and 194395, were resistant to rust at Poplarville.

Wide differences in seed setting, plant type, leaf width and other agronomic characters have been noted. The *Lolium* species are diploid, having a $2n$ chromosome number of 14. Natural polyploidy does not occur in the genus. The ryegrasses are cross-pollinated sexually reproducing species. Plants are in general highly self-sterile. Loss of vigor from selfing may be as much as 60% in one generation.

Bermuda, *Cynodon dactylon* - G. W. Burton, Ga.

Since the time allotted for the grass breeding program was nearly up, Dr. Burton briefly reviewed the status of breeding in Bermuda and Bahia grasses. Main objective in breeding programs on Bermuda grass is to develop more productive strains for pasture. Palatability and frost

tolerance are secondary objectives... Compatibility with legumes, diseases, and heat and drought tolerance are factors of concern in the breeding programs but subordinate to the above.

Bermuda grass has a chromosome number of $2n = 36$, with satellites or occasional fragments. Studies of meiosis have not been reported. Common Bermuda appears to be completely sexual and highly cross-pollinated in its method of reproduction. Open pollinated progenies are highly variable. Marked heterosis has been observed in a few hybrid plants.

Bahia grass, *Paspalum notatum* - C. W. Burton, Ga.

According to the summary of breeding objectives, table 1, increased forage yields and palatability are the primary objectives of the breeders. Greater disease resistance and frost tolerance are objectives receiving attention. Drought resistance, winter hardiness and compatibility with legumes are factors of minor importance over most of the area.

Pensacola Bahia ($2n = 20$) forms 10 pairs of chromosomes at meiosis and meiosis is regular. Common Bahia, P.I. 158822 and Paraguayan lawn type ($2n = 40$), are autotetraploids. Meiosis is irregular due to the formation of univalents and multivalents. Univalents are often not oriented at the metaphase I plate. One or more lagging univalents have been observed in 48% of the anaphase I sporocytes of P.I. 158822, and 45% of Paraguayan lawn type. The number of quadrivalents per sporocyte observed at diakinesis ranged from 2 to 10, with an average of 5.44 in Cuban common. Average frequency of all associations at diakinesis in Cuban common was .24 I's, 8.64 II's, .24 III's and 5.44 IV's. A large proportion of gametes with unbalanced chromosome complements are produced as a result of the loss and unequal distribution of chromosomes. The hybrid Pensacola x common ($2n = 30$) exhibits the irregularities of meiosis expected in an autotriploid and the high rate of trivalent formation, 6 to 10 per sporocyte, indicates a high degree of homology between Pensacola and Common genomes. A single chromatin bridge observed in 12% of the anaphase I sporocytes may be due to a heterozygous inversion in the hybrid examined.

The evidence available to date indicates that the diploid Pensacola Bahia reproduces sexually and is highly cross pollinated. Common broad-leaved Bahia (Cuban, etc.), Argentine and P.I. 158822 are tetraploids that, judging from progeny studies (and also cytogenetic studies in the case of Common), reproduce almost entirely by apomixis.

Pensacola Bahia loses vigor upon selfing and most plants are highly self-sterile. Certain self-sterile clones when interplanted and allowed to cross naturally have produced progenies yielding about 25% more than commercial Pensacola Bahia. Apomixis has been so complete in the tetraploid Bahias that selection and hybridization within them has not been fruitful.

Table 1. Grass breeding objectives and their relative importance, as reported by Experiment Station workers in the South.

Breeding objectives	Average relative importance					
	Tall fescue	Orchard grass	Dallis grass	Rye-grass	Bermuda grass	Bahia grass
Adaptation			4.2			
Compatibility with legumes	10.8	.4	5.0	4.4	7.8	4.0
Diseases	18.3	23.0	45.0	38.8	7.8	18.0
Easier control					1.1	3.0
Fall growth				21.6		
Frost tolerance	5.7	8.6	2.5		11.1	17.0
Greater stooling		1.8		1.3		
Heat & drought tolerance		25.2			6.7	6.0
Increased yield	14.6	9.0	10.8	18.7	46.7	27.0
Leafiness		7.1	4.2			
Longevity	10.4	12.8		3.6		
Maturity -						
Earliness		1.3		2.5	2.2	
Lateness		4.9		5.8		
Palatability	26.3	2.4	1.7		11.7	23.0
Reseeding ability				3.1		
Seed viability & seedling vigor			26.7			
Seed yields	2.3		3.3		1.1	1.0
Winter injury					3.3	5.0
No. of states reporting	11	9	6	8	9	7

11:00 A.M. Legume Breeding - E. N. Fergus, Chairman.

Dr. Fergus called attention to the plan of leaving discussion leaders to cover the problems concerning the breeding of the various legumes. Each of the discussion leaders had, previous to the Conference, contacted research workers as to the breeding objectives and also as to the progress of work. A summary of the replies had been prepared and mimeographed for consideration of the members of the Conference. (To save space, a summary of breeding objectives for all legumes is attached).

White clover, *Trifolium repens* - P. B. Gibson, Ala.

Dr. Gibson called attention to the most important single objective as listed on the mimeographed form by southern breeders, that of getting greater longevity into white clover varieties. Important factors contributing to short-lived stands of white clover were disease injury and drought damage. Techniques are needed for screening large populations of white clover for susceptibility to the more serious diseases, according to Dr. Gibson. In addition to the breeding program at Auburn, Dr. Gibson is conducting fundamental studies of the factors affecting the longevity or persistence of white clover plants. The cytology, breeding behavior, and techniques of white clover breeding are summarized as follows:

1. Cytology - $2n = 32$; meiosis very regular in both pairing and disjunction of chromosomes; probably an amphidiploid and probably shows mostly disomic inheritance.
2. Breeding Behavior and Method of Reproduction - Natural crossing by insects is undoubtedly the primary means of pollination. Most plants are self-incompatible. A plant may set some seed per head following selfing. The ability to do this is termed pseudo-self-compatibility. True self-compatibility also exists. Selected clones are maintained easily by vegetative cuttings. White clover is commonly recognized as a highly polymorphic species. This has given rise to many strains, both by natural selection and by the process of mass selection.
3. Breeding Techniques - The breeding techniques applicable to the improvement of alfalfa and other cross-fertilized plants are used by white clover breeders. A common method is to identify desirable clones by means of the polycross test and to simultaneously preserve these clones into a synthetic variety.
4. Related Research - Fundamental studies designed to obtain data which will indicate the relative importance of the variables affecting the persistence of white clover are planned or are under way at two stations.

Dr. Wallace reported that they were primarily interested in lupines in their breeding program to develop better winter annual legumes in Florida. Problems are many. Increased winter hardiness, disease resistance, non-shattering, increased seed production, and greater productivity, especially with respect to low alkaloid lines, are primary objectives. Seeds will be X-rayed in an effort to secure vigorous, low-alkaloid lines with greater disease resistance. We are screening introductions for resistance to diseases, particularly for resistance to virus. Important diseases of lupines are brown spot, Ceratophorum setosum, various viruses, and anthracnose, Glomerella cingulata. The acreage of the yellow lupine, L. luteus, is increasing in the southern edge of the lupine area, due in part to its apparent resistance to the fly damage caused by Hylemia lupini. Breeding programs are under way in Florida and Georgia. Breeding for disease resistance in winter field peas, Pisum arvense, has been discontinued. There are no intensive breeding programs under way with the vetch species.

11:45 A.M. Lunch.

1:00 P.M. Legume Breeding(Cont.) - E. N. Fergus, Chairman.

Sericea lespedeza, Lespedeza cuneata - J. M. Elrod, Ga.

In discussing the importance of sericea lespedeza, Mr. Elrod stated that the interest in this species in Georgia is greater than for any other legume. According to Mr. Elrod, little attention was paid to an early and probably the first introduction of this species in 1896. Greater interest was shown in introductions made in 1924 and 1925. The earlier observations indicated that sericea was low in palatability; however, livestock men were not in agreement in this regard. The Soil Conservation Service publicized the soil conserving value of the species and further stimulated its use.

Seven southern states indicated their interest in breeding sericea lespedeza. (It should be noted that in contrast to other legumes reported, disease resistance is not of concern to plant breeders at this time). Attention was called to the fact that sericea produces two types of flowers, cleistogamous and chasmogamous(normal), on the same plant. Observations of the development of cleistogamous flowers indicate a close similarity to the annual species, L. stipulacea. It is concluded that the cleistogamous flowers of sericea are self-pollinated. The chasmogamous flowers may or may not be self-pollinated. Stitt, working in North Carolina, reported crossing in the chasmogamous flowers as high as 80%. The table clearly shows that the principal aim of plant breeders is pointed toward greater palatability of the species. Emphasis on the development of more palatable(low tannin) lines in the breeding programs was questioned by Dr. Donnelly of the Alabama Station. He felt that other factors were equally, if not more

important. We do not have any data or direct evidence that tannin is responsible for low palatability, as so frequently is indicated in reports. Attention was called to the fact that we do not know the composition of the tannins in sericea. We know nothing of its structure and little of the factors responsible for accumulation of tannin in the leaves of the plant. The need for such studies was stressed, plus an evaluation of high and low tannin lines from a nutritive standpoint.

Alfalfa Breeding, *Medicago sativa* - C. H. Hanson, N. Car.

The questionnaire with regard to breeding objectives and progress in breeding alfalfa was sent to 13 states. The importance given to the various breeding objectives varied over the region. Texas and Oklahoma workers place more emphasis on drought resistance, while in Virginia, longevity and resistance to diseases are major objectives. In the overall summary, greater longevity, increased disease and drought resistance, and increased yields are major objectives. As to disease resistance, the importance of securing resistance to bacterial wilt and the *Fusaria* sp. was stressed by Arkansas workers. The more important diseases, as indicated in the regional breeding objectives, were anthracnose, black stem, Pseudopeziza leaf spot, and Sclerotinia. Dr. Hanson reviewed the alfalfa breeding program under way at the North Carolina Station as follows:

- A. Cytology and breeding behavior - A high frequency of pairing irregularities during meiosis and a chromosome number of 32 (2n) indicate that *M. sativa* is of tetraploid origin. Limited quadrivalent formation suggests autopolyploidy. Genetic data is not conclusive but some of it, at least, supports an allopolyploid origin for the species.
- B. Method of reproduction - Predominately cross-pollinated.
- C. Breeding techniques - (a) Selection in old fields for persistent individuals, (b) clonal propagation for more thorough evaluation of a particular genotype for clonal and outcrossed progeny performance, (c) controlled testing of resistance to most diseases, (d) polycross testing for determining general combining ability. A breeding procedure which takes advantage of the polycross test, the selfed progeny test, and which incorporates the essential features of recurrent reciprocal selection also will be presented.

Crimson Clover, *Trifolium incarnatum* - L. V. Crowder, Ga.

Dr. Crowder called attention to the very rapid increase of crimson clover in the South in recent years. The importance of the crop is indicated by seed production figures. Six hundred thousand pounds of

seed were produced in 1936; 7,847,000 in 1941, and over 27,000,000 in 1951. There has been very little breeding work done with crimson clover. A brief resume of the work done is as follows:

1. Cytology - Reports of chromosome numbers of $2n = 14$ and 16.
2. Method of Reproduction - Largely cross-pollinated (one report of 68%) but self-sterile.
3. Breeding Behavior - Significant reduction in vigor on selfing, but selfed lines can be maintained.
 - (b) Large variation in flower color, crimson dominant, white recessive, pinks breed true.
 - (c) Appears doubtful that seed impermeability is inherited unless masked by environment.
 - (d) One male sterile plant was found but has been lost.
4. Breeding Techniques -
 - (a) Selection of markers to identify strains.
 - (b) Selection on basis of selfed progeny and development of inbred lines. These are to be combined into synthetic varieties on basis of polycross performance.
 - (c) Attempt to secure non-shattering of seed by interspecific cross with Trifolium angustifolium.

The merits of crimson clover and the varieties or strains being grown in the South was reviewed by Dr. Crowder. According to the summary of breeding objectives, disease resistance and increased yields are main objectives. Greater fall growth is an important objective in three of the five states reporting. Mississippi and Alabama have initiated breeding programs in recent years. Dr. Bennett, of Mississippi, is making progress in getting resistance to sooty blotch. Dr. Hollowell of the Department of Agriculture at Beltsville, Md., is searching for crown rot resistance.

Annual Lespedeza, Lespedeza stipulacea - P. C. Sandal, Ark.

The summarized report from 8 states, covering breeding objectives and progress in breeding, was presented and discussed by Dr. Sandal. In general, breeding for disease resistance, primarily resistance to root knot nematodes, was recognized as the most important single breeding objective. Rhizoctonia, Sclerotinia rolfsii, and powdery mildew were rated as important diseases of annual lespedeza in certain states. Improvements in yield, seed production, and in drought resistance are important other objectives in the breeding programs. Progress in securing greater yield, nematode and powdery mildew resistance and in securing higher yielding strains was reported from Arkansas, Louisiana and Oklahoma. Seed from a number of crosses made by Dr. Hanson, at North Carolina, were sent to interested workers last spring. Dr. Sandal stated that he planned to reselect within this material for

Table 2. Legume breeding objectives and their relative importance, as reported by Experiment Station workers in the South.

Breeding objectives	Average relative importance					Avg.
	White clover	Alfalfa	Crimson clover	Lespedeza Sericea	Annual	
Increased yield	12.0	14.4	25.0	13.0	26.2	18.1
Greater longevity	36.0	27.5	15.0	7.0	2.5	17.6
" winterhardiness	2.0	3.0				1.0
" seed production	3.0	2.0	5.0	3.0	10.0	4.6
" leafiness		5.9				1.2
" drought resist.	19.0	6.5			6.3	6.4
Recovery after cutting		4.0				.8
Tolerance to grazing		4.0		14.0		3.6
Resist. to disease	19.0	26.7	27.0		45.0	23.5
" " insects		7.0			1.2	1.6
Compatibility with grasses	6.0		5.0		3.1	2.8
Seedling vigor & fall growth	3.0		10.0	7.0		4.0
Seed shattering			8.0		1.2	1.8
" hardness			5.0			1.0
Lower tannin				51.0		10.2
Later maturity					4.4	.9
Palatability				4.0		.8
No. of states reporting	5	10	5	7	8	

types better adapted to Arkansas conditions. A brief resume of the behavior of the species is as follows:

1. Cytology - In the inconspicuous flowers the pollen grains germinate in the closed anther sacs; the pollen tubes grow through the anther sac wall and into the stigma. The essential features of meiosis, microgametogenesis and fertilization appear to be identical in the inconspicuous and in the showy flowers.
2. Method of Reproduction - Predominately self-pollinated but some natural crossing occurs.
3. Breeding Behavior - F₂ distributions indicated that flower color, reaction to powdery mildew, growth habit and erectness of main stem are each conditioned by at least two gene pairs. Linkages were indicated for the following: (1) flower color and reaction to powdery mildew, (2) flower color and date of first bloom, and (3) date of first bloom and erectness of main stem.
4. Breeding Techniques. - Controlled cross-pollination was very successful (in the bud stage) when emasculation was omitted. The ovary is receptive to fertilization one to several days before the flower undergoes anthesis.

2:30 P.M. Meeting adjourned.

Dr. Fergus adjourned the meeting after thanking those participating in the program.

Friday, April 25, 1952

3:00 P.M. .

Pleasant Hall, Room C.

General Session - T. H. Rogers, Chairman.

Dr. Rogers called the meeting to order. He called attention to the action of the group at the Alabama meeting the previous year with respect to the increase in the occurrence of bloat in the South in recent years. Dr. H. W. Marston was then introduced.

Bloat, Causes, Losses, Investigations - H. W. Marston, Md.

Dr. Marston, in opening the topic for discussion, brought the group up to date on the subject of bloat as a national problem. He reported briefly on the bloat conference held at Chicago at the Congress Hotel on November 27-28, 1951. For purposes of discussion, the conference at Chicago was divided into five panels as follows: (1) Rumens

physiology, (2) Physio-Pathology, (3) Agronomy, (4) Animal management, and (5) Microbiology. As each phase was discussed, interesting angles were developed; however, no unanimous specifications were drawn up as to how to prevent bloat under all conditions. Mimeographed copies of the Chicago conference were available to members. Dr. Marston discussed the various methods of preventing bloat. Management, both plant and animal, seems to be the most effective means of preventing bloat. Maintaining 50% grass in association with legumes reduces bloat. The feeding of roughage before turning cattle on lush pastures is effective in part, however, such a practice would not be effective where afternoon bloat is common. Bloat is reported to be less on cloudy, dull days. Differences in animals, some being chronic "bloaters", is a common observation. At the Chicago meeting, veterinarians in general gave the impression that present methods of bloat control were effective in most cases. Dr. Marston called attention to the article, "The Review of Bloat", from the National Research Council, by H. H. Cole, C. F. Huffman, T. M. Olsen and A. F. Sharp, August 1945.

The meeting then opened for questions and discussions from the floor. Mr. Deikle, a Louisiana farmer, offered his bloat problem to the Conference for suggestions. On Mr. Deikle's farm (river bottom land), clover is growing luxuriantly and bloat in his cattle herd has become a major problem. He has 450 head of cows on 650 acres. He stated that bloat in his herd occurred in the afternoon. He has kept hay on the ground and has also tried feeding hay in the afternoon but lost five cows. Cattle coming into his pastures from the levee from predominately grass land did not bloat to the same extent as his own cattle. Cattle received from Mississippi bloated worse than his older stock. In addition to hay feeding, Mr. Deikle stated that he is mowing strips around the pastures and has lost three cattle in the past three days. He has had to use either a knife or trocar on quite a number of cows and many saved by this method are grazing with the rest of the herd with the punctures remaining open. The local veterinarian has recommended that the puncture remain open until the incidence of bloat declines. The bloat situation has become so serious with Mr. Deikle that he may be forced out of the livestock business.

No real solution was offered Mr. Deikle. It was recognized that the fall and winter in this area had been particularly favorable to the growth of the clovers, primarily white. Under such conditions it is difficult to manage pastures so as to prevent the predominance of clover. During most years, in this area, ryegrass, tall fescue and other winter growing grasses provide a good grazing mixture.

Dr. Hogg (Mississippi Delta) reported that where they had 50% grass (tall fescue) they had little or no bloat, however, certain animals were chronic bloaters. On Ladino clover, out of a herd of 40 steers, approximately 1/3 would not bloat and 1/3 were chronic bloaters and would bloat twice daily. Heavy nitrogen fertilization

stimulates the growth of tall fescue and reduces content of Ladino clover. Mr. Oakes (Red River Valley, Curtis, La.) reported that even with a 50-50 grass and legume mixture, cattle will bloat. Certain animals will eat only clover.

Prof. McCraime of the Animal Industry Department, Louisiana State University, reported that over a 16-year period, their greatest losses occurred in cattle that were not used to clover pasture. Feeder calves and cattle coming from pine land areas of southern Louisiana and Mississippi were particularly susceptible to bloating. Similar experiences were reported by experiment station workers and farmers in the Louisiana-Mississippi areas.

In closing the discussion, Dr. Marston stated that the solution to the bloat problem, as indicated in this discussion and from the previous conference, is not a simple one but one that requires the combined and coordinated efforts of the plant and animal workers.

4:30 P.M. Business Meeting - T. H. Rogers, Chairman.

Dr. Rogers announced that the Executive Committee had met and elected Dr. R. C. Potts, Texas, as Chairman for next year. The election of a new member of the Executive Committee proceeded. Dr. P. C. Sandal, Arkansas, was nominated and unanimously elected. The Executive Committee for next year is as follows:

G. B. Killinger, Florida	1953
T. H. Rogers, Alabama	1954
R. C. Potts, Texas	1955, Chairman
J. K. Leasure, Tennessee	1956
P. C. Sandal, Arkansas	1957
R. H. Lush, Tenn., Dairy Husb.	
H. H. Leveck, Miss., Animal Husb.	
P. R. Henson, Permanent Secretary.	

Dr. Rogers called to the attention of the members that, as requested by vote in last year's meeting, the type of program was changed to more discussions and fewer field trips. The question was raised as to the wishes of the members with respect to next year's Conference. A number of the members expressed the opinion that this type of meeting had been most informative and suggested that the same type of program be planned for next year.

Dr. R. E. Blaser, Virginia, as authorized by Director Dunton, invited the group to Virginia in 1953 to meet either at Blacksburg or Middleburg. To handle such a large group, Dr. Blaser felt that it may be necessary to have the Conference in July or August. The invitation to meet in Virginia in 1953 was voted on and passed by the members present.

Mr. M. A. Hein of the Plant Industry Station, Beltsville, Md., complimented the members of the host institution for the excellent arrangements and facilities for handling the Conference. The motion was made, seconded and passed, that the secretary be instructed to write a letter of appreciation to Dr. Taggart for having contributed so greatly to a very successful Conference.

5:10 P.M. Conference adjourned.

REGISTRATION LIST - 1952

<u>Name</u>	<u>Address</u>	<u>Firm Represented</u>
Anthony, W. H.	Opelousas, Louisiana	Farm Service, Inc.
Atkins, J. G.	3954 Hundred Oaks,	L.S.U., Baton Rouge, La.
Ayers, Thomas L.	Washington, D. C.	P.M.A. - USDA
Barrick, E. R.	Raleigh, N. Carolina	N.C. State College
Bashaw, E. C.	College Station, Texas	Texas A.& M. College
Beard, D. F.	Beltsville, Maryland	Plant Industry Station
Beaubouef, L. V.	Franklington, Louisiana	S.E. La. Experiment Sta.
Black, David E.	Crowley, Louisiana	La. State Univ.
Boneta, Efrain	Rio Piedras, Puerto Rico	Agric. Expt. Station
Brupbacher, R. H.	1234 Stephens Ave.,	LSU, Baton Rouge, La.
Buckner, Robert C.	Lexington, Kentucky	Agric. Expt. Station
Burns, Joe D.	Auburn, Alabama	Ala. Polytechnic Inst.
Burns, Robert E.	Experiment, Georgia	Bureau Plant Industry
Cain, C. C.	Lafayette, Louisiana	S.W. La. Inst.
Campbell, R. S.	New Orleans, Louisiana	Sou. Forest Expt. Sta.
Cantwell, Dallas	Atlanta, Georgia	Spencer Chemical Co.
Cassady, John T.	Alexandria, Louisiana	Sou. Forest Expt. Sta.
Crowder, Loy V.	Experiment, Georgia	Agric. Expt. Station
Daniel, Edward	St. Francisville, Louisiana	
Dee, W. E.	Amite, Louisiana	Soil Conservation Serv.
Denman, Charles E.	Stillwater, Oklahoma	Okla. A.& M. College
DeVane, Earl H.	Tifton, Georgia	Coastal Plain Expt. Sta.
Donnelly, E. D.	Auburn, Alabama	Ala. Polytechnic Inst.
Driskell, B. N.	Baton Rouge, Louisiana	La. State Univ.
Elder, W. C.	Stillwater, Oklahoma	Okla. A.& M. College
Elrod, Julius M.	Griffin, Georgia	Agric. Expt. Station
Erdman, Lewis W.	Silver Spring, Maryland	Plant Industry Station
Fergus, E. N.	Lexington, Kentucky	University of Ky.
Fisher, Warner D.	College Station, Texas	Texas A.& M. College
Flint, R. N.	Baton Rouge, Louisiana	State Dept. of Agric.
Forbes, I. L.	Baton Rouge, Louisiana	La. State Univ.
Garrett, H. A.	St. Francisville, Louisiana	
Garrison, C. S.	Beltsville, Maryland	Plant Industry Station
Gibson, Pryce B.	Auburn, Alabama	Agric. Expt. Station
Gill, John B.	Raymond, Mississippi	Brown Loam Branch Sta.
Golden, Laron E.	Magnolia, Arkansas	Southern State College
Gray, John P.	Baton Rouge, Louisiana	Agric. Expt. Station

Registration list (cont.)

Hackerott, Harold L.	Renner, Texas	Texas Research Foundation
Haddon, C. B.	St. Joseph, Louisiana	N.E. Agric. Expt. Sta.
Hanson, C. H.	Raleigh, North Carolina	Agric. Expt. Station
Harvey, Clark	College Station, Texas	Texas A. & M. College
Hein, M. A.	Beltsville, Maryland	Plant Industry Station
Henson Paul R.	" "	" " "
Hodgkins, E. E.	Franklinton, Louisiana	S.E. La. Expt. Sta.
Hogg, Peter G.	Stoneville, Mississippi	Delta Expt. Station
Hollowell, E. A.	Beltsville, Maryland	Plant Industry Station
Holt, Ethan C.	College Station, Texas	Texas A. & M. College
Horner, Earl S.	Gainesville, Florida	Agric. Expt. Station
Hulburt, Walter C.	Beltsville, Maryland	USDA, Agric. Res. Adm.
Hutton, C. E.	Jay, Florida	University of Florida
James, Edwin	Griffin, Georgia	Agric. Expt. Station
Johnson, Howard W.	Leland, Mississippi	Delta Expt. Station
Johnson, Paul E.	Knoxville, Tennessee	Univ. of Tenn.
Jones, D. W.	Ona, Florida	Range Cattle Expt. Sta.
Killinger, G. B.	Gainesville, Florida	Agric. Expt. Station
Knight, W. E.	State College, Mississippi	" " "
Kornegay, Charlie L.	Tallasse, Alabama	Agric. Expt. Station
Krauskopf, F. G., Jr.	Houston, Texas	Univ. of Houston
Kuykendall, Roy	Newton, Mississippi	Coastal Plain Br. Expt. Sta.
Langford, W. R.	Jay, Florida	Univ. of Florida
Leasure, J. K.	Knoxville, Tennessee	Univ. of Tennessee
Lee, J. G., Jr.	Baton Rouge, Louisiana	La. State Univ.
Lucas, H. L.	Raleigh, North Carolina	N. C. State College
Lush, R. H.	Knoxville, Tennessee	Agric. Expt. Station
McCormick, L. L.	Bossier City, Louisiana	Red River Valley Expt. Sta.
McCrory, S. J.	Baton Rouge, Louisiana	La. Dept. of Agric.
Marchant, W. H.	Tifton, Georgia	Coastal Plain Expt. Sta.
Melville, David R.	Baton Rouge, Louisiana	La. State Univ.
Min, Kyaw	Rangoon, Burma	Education Dept.
Morgan, N. D.	Shreveport, Louisiana	American Potash Inst.
Oakes, J. Y.	Bossier City, Louisiana	Red River Valley Exp. Sta.
Owen, C. R.	Baton Rouge, Louisiana	La. State Univ.
Patterson, R. M.	Auburn, Alabama	Ala. Polytechnic Inst.
Pearson, C. F.	Mobile, Alabama	Pearson & Company
Peek, J. M.	Lafayette, Louisiana	S.W. Louisiana Inst.
Peevy, Fred A.	Alexandria, Louisiana	
Peevy, W. J.	Baton Rouge, Louisiana	La. State Univ.
Percy, Wallace	Bains, Louisiana	Afton Villa Farms
Potts, R. C.	Bryan, Texas	Agric. Expt. Station
Prince, Allan B.	Clemson, South Carolina	Clemson College
Riewe, Marvin E.	Angleton, Texas	Agric. Expt. Station
Rivera-Brenes, Luis	Rio Piedras, Puerto Rico	Agric. Expt. Station
Rogers, Hayden	Auburn, Alabama	Agric. Expt. Station
Sandal, P. C.	Fayetteville, Arkansas	University of Ark.
Scarsbrook, C. E.	Baton Rouge, Louisiana	La. State Univ.
Self, F. W.	" " "	" " "

Registration list (Cont.)

Sell, O. E.	Experiment, Georgia	Agric. Expt. Station
Simmons, Henry	Nashville, Tennessee	Farm & Ranch Magazine
Simon, E. C.	Baton Rouge, Louisiana	La. State Univ.
Spencer, N. B.	" " "	Chilean Nitrate Sales Corp.
Stroube, W. F.	" " "	La. State Univ.
Sturgis, M. B.	" " "	" " "
Sturkie, D. G.	Auburn, Alabama	Ala. Polytechnic Inst.
Timonin, M. I.	Mobile, Alabama	Pearson & Company
Underwood, J. K.	Knoxville, Tennessee	Univ. of Tenn.
Walker, R. K.	Crowley, Louisiana	Rice Expt. Station
Wallace, A. T.	Gainesville, Florida	Univ. of Florida
Washko, W. W.	Renner, Texas	Texas Research Foundation
Weihing, Ralph M.	Beaumont, Texas	Rice-Pasture Expt. Sta.
Whitehair, C. K.	Urbana, Illinois	Univ. of Illinois
Williams, John S.	Houston, Texas	Univ. of Houston
Willis, W. H.	Baton Rouge, Louisiana	La. State Univ.
Wilson, Lane	Shreveport, Louisiana	
Windham, Louis A.	Baton Rouge, Louisiana	La. Agricultural Coop.
Wise, Louis N.	State College, Mississippi	Agric. Expt. Station
Woodhouse, W. W. Jr.	Raleigh, North Carolina	N. C. State College

